AMENDMENTS TO THE DRAWINGS

The attached sheets of drawings include changes to Figs. 1-6. These sheets, which include Figs. 1-6, replace the original sheets including Figs. 1-6. Changes incorporated in these sheets are highlighted on the attached annotated copies.

Attachment: Replacement Sheets

Annotated Sheets Showing Changes

REMARKS

Claims 11-26 remain in this application. Claims 11, 13-21 and 26 have been amended while the remaining claims are unchanged. No new subject matter is believed to have been added by this Amendment.

In Section No. 1 of the Office Action, the Examiner indicates that Figs. 1-6 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. The Prior Art legend has been added to Figs. 1-6.

In Section No. 2 of the Office Action, the Examiner objects to the drawings as failing to comply with 37 CFR §1.84(p)(4) because two different reference characters (3), (11), have been used to designate a singular item, the injection valve, hereinafter referred to as the expansion valve. Please note that the actual expansion valve illustrated, for example, in Fig. 2, is reference number (3), while regions on the thermodynamic curve, for example, Fig. 9, representing the region upstream of the expansion valve (3) is referred to as reference number (1). In particular, on page 5, line 24 of the Specification, reference number (11) does not refer to the injection valve, but refers to the liquid entry temperature into the expansion valve (3). For that reason, the Applicant believes that the reference number (11) on page 5, line 24 is appropriate.

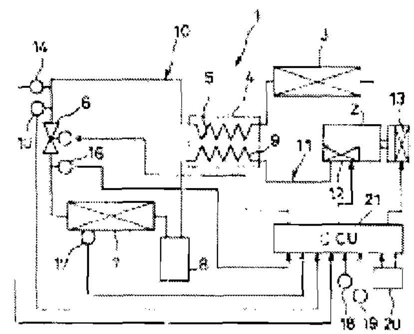
In Section No. 4 of the Office Action, the Examiner indicates that the term "the expansion valve" and the term "the injection valve" are both indicated by reference number (3). The Specification has been amended such that each occurrence of "the injection valve" has been changed to "the expansion valve".

In Section No. 1 of the Claim Objections, the Examiner objects to claims 13-18 for reasons set forth on pages 3, 4 and 5 of the Office Action. The claims have been amended to address these objections.

In Section No. 6 of the Office Action, the Examiner rejects claims 11, 12, 17, and 21 under 35 U.S.C. §102(e) as being anticipated by the teaching of Japanese Patent No. JP 2002267279 to Yoshihiko (hereinafter the "Yoshihiko patent").

The Yoshihiko patent teaches (see Fig. 2 below) the cooling circuit for an air-conditioner of a car, wherein a compressor (2) in the usual way receives refrigerant vapour (carbon dioxide) via a low-pressure line (11) from an accumulator (8) located at the outlet of an evaporator (7).

【図2】

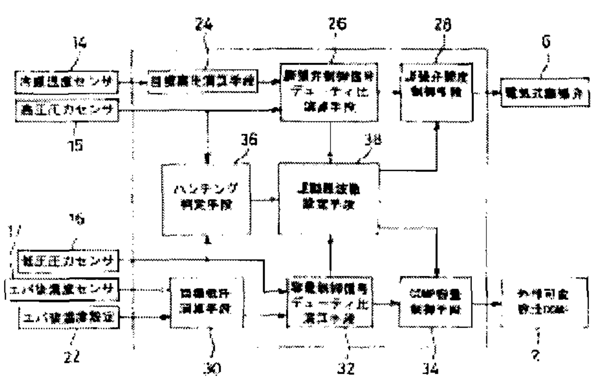


The compressed refrigerant is cooled (and liquefied) by passing a radiator (3). It then passes an internal heat exchanger (4) and is finally expanded by means of an expansion valve (6) to enter the evaporator (7) again.

A refrigerant temperature detection means (14) and a high pressure sensing means (15) are arranged at the entrance of the expansion valve (6). Furthermore, a low-pressure pressure sensing means (16) is arranged at the output side of the expansion valve (6). Signals of the detecting and sensing means (14, 15, 16) are sent to an electronic control unit (21), which generates control frequency signals to control the expansion valve (6) and a valve of a capacity variable mechanism (12) at the compressor (2) in a duty ratio operation mode.

As can be seen in Fig. 1 of the Yoshihiko patent (see below), both the expansion valve (6) and the discharging volume of the compressor (2) are controlled,

【図1】



whereby the control of the discharging volume of the compressor is based on the low-pressure pressure (sensing means 16) and the degree of expansion valve-opening is controlled based on the high-pressure pressure (sensing means 15).

According to the present application (see Fig. 10 below) only the expansion valve (3) is controlled by means of the measured liquid refrigerant temperature (11) upstream of the expansion valve (3) and the measured evaporation pressure (12) at the inlet of the

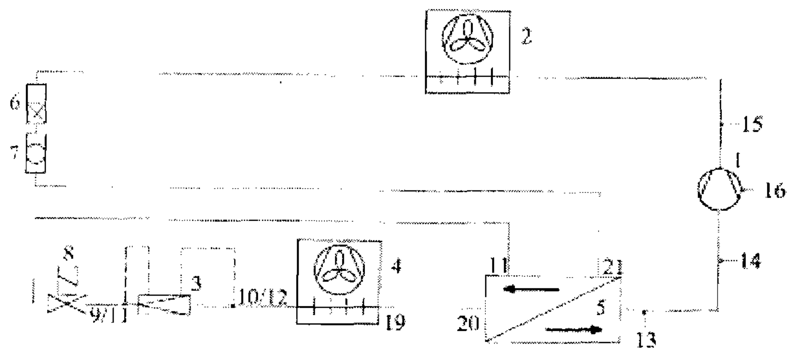


Fig. 10

evaporator (4) (see dashed control lines in Fig. 10). Furthermore, the control of the expansion valve (3) is used to control the onset (or beginning or start) of the evaporation at the left-hand (rising) part of the phase-boundary curve in the lg (p, h) diagram of the refrigerant used (see Fig. 7-9 of the present application).

Thus, the control schemes of the Yoshihiko patent and the present application are completely different.

In Section No. 7 of the Office Action, the Examiner rejects claims 11, 12, 15, and 16 under 35 U.S.C. §102(e) as being anticipated by the teaching of United States Patent No. 6,817,193 to Caesar, et al. (hereinafter the "Caesar patent").

The Caesar patent teaches a method for operating an internal combustion engine-driven refrigerant circuit for a motor vehicle air-conditioning system. According to the Caesar patent, a refrigerant circuit of an air-conditioning system of a motor vehicle has a refrigerant compressor for compressing substantially gaseous refrigerant, a cooler, which is connected downstream of the refrigerant compressor, for dissipating heat from the refrigerant, a restrictor means for expanding the refrigerant, and an evaporator for transferring heat to the refrigerant. Pressure in the refrigerant circuit is measured firstly, on a high-pressure side by way of at least one pressure-measuring device, and secondly, on the low-pressure side by way of the at least one pressure-measuring device. The refrigerant is almost completely liquefied in the refrigerant circuit upstream of the restrictor means.

Approximately complete liquefaction of the refrigerant occurs upstream of the restrictor means (expansion valve). Complete liquefaction means that it is possible to achieve a state of the refrigerant which can be recorded unambiguously. This allows accurate and reliable determination of the refrigerant mass flow by means of thermodynamic variables, such as pressure and temperature, at the restrictor means. It is preferable for the refrigerant to be at least slightly supercooled in order to achieve complete liquefaction. The invention allows accurate determination of the refrigerant mass flow. Together, with the knowledge of the compressor rotational speed and the compressor design, it is possible to calculate the compressor torque with sufficient accuracy for torque communication with the driving engine of the vehicle. It is also possible to satisfy torque stipulations of the driving engine by setting a refrigerant mass flow. Furthermore, the refrigeration circuit can be controlled as required, by utilizing the knowledge of the output provided in the refrigeration system. If the air temperature in the interior of the vehicle, which is relevant to comfort and safety, is too low, the output, i.e. the circulating refrigerant mass flow, is reduced. If the temperature in the interior of the vehicle is too high, the circulating refrigerant mass flow is increased. The variation is effected by changing the refrigerant mass flow in the compressor. The temperature of the evaporator can be determined by means of the determined and, therefore, known pressure downstream of the restrictor means, and it is therefore possible to reliably prevent the temperature from dropping below the freezing point, leading to icing. This makes it simple to achieve an output or comfort control of the refrigeration circuit by using knowledge of the refrigerant mass flow. As a result, there is no need to measure the temperature of the air downstream of the evaporator. This results in a high potential cost saving (col. 2, lines 5-64).

Thus, according to the Caesar patent, the control of the refrigerant circuit and the pressure and temperature measurements are exclusively directed to the exact determination of the refrigerant mass flow, which is of central importance for the interaction between the refrigerant circuit and its compressor and the operation of the internal combustion engine of the motor vehicle.

A control of the onset point of the evaporation, as claimed in the present application, is not disclosed by the Caesar patent.

In Section No. 10 of the Office Action, the Examiner rejects claims 13, 14, and 16 under 35 U.S.C. §103(a) as being obvious from the teaching of the Yoshihiko patent,

in view of the teaching of European Patent EP-1014013 to Shunji, et al. By way of their dependence upon what is believed to be patentably distinct independent claim 11, dependent claims 13, 14, and 16 are themselves believed to be patentably distinct over the prior art of record.

In Section No. 11 of the Office Action, the Examiner rejects claims 18-20 and 22-26 under 35 U.S.C. §103(a) as being obvious from the teaching of the Yoshihiko patent. Once again, by way of their dependence upon what is believed to be patentably distinct independent claim 11, dependent claims 18-20 and 22-26 are themselves believed to be patentably distinct over the prior art of record.

Reconsideration and allowance of pending claims 11-26 are respectfully requested.

Respectfully submitted,

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